

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
27 January 2005 (27.01.2005)

PCT

(10) International Publication Number  
**WO 2005/008223 A3**

(51) International Patent Classification<sup>7</sup>: **G06T 7/00** (74) Agent: FAHMI, Tarek; Blakely, Sokoloff, Taylor & Zafman LLP, 12400 Wilshire Boulevard, Seventh Floor, Los Angeles, CA 90025-1030 (US).

(21) International Application Number:  
**PCT/US2004/023024**

(22) International Filing Date: 15 July 2004 (15.07.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/488,561 18 July 2003 (18.07.2003) US

(71) Applicant (for AE, AG, AL, AM, AT, AU, AZ, BA, BB, BE, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CY, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM only): APPLIED MATERIALS ISRAEL, LTD. [IL/IL]; 8 Oppenheimer Street, 76236 Rehovot (IL).

(71) Applicant (for ZW only): APPLIED MATERIALS, INC. [US/US]; P.O. Box 450A, Santa Clara, CA 95052 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): KARSENTI, Laurent [IL/IL]; Rehovot (IL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

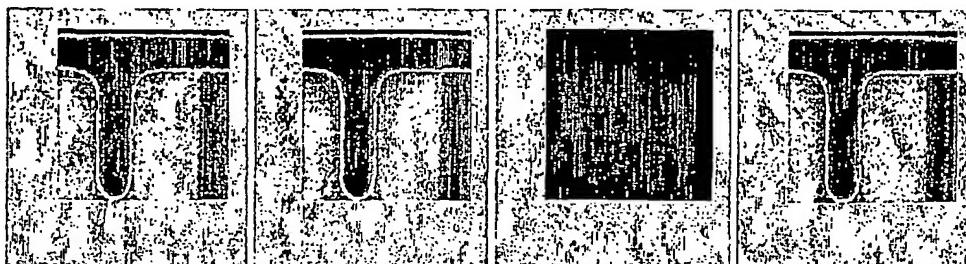
Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:  
14 July 2005

{Continued on next page}

(54) Title: METHODS FOR DEFECT DETECTION AND PROCESS MONITORING BASED ON SEM IMAGES



(57) Abstract: A morphological operation is applied to an SEM image to obtain a idealized image, and the idealized image is used to detect a defect in a subject of the SEM image. The defect is detected by subtraction of the idealized image from the original image. Morphological operations are used also to entrance the visibility of defects or to check for irregularities in patterns. Other described methods comprise: growing a flow from seed points in the image, in order to define maps in which particles can be identified; checking for separation of objects in the image by growing flows from seed points located on the objects; segmenting the image into supposed identical objects and applying statistical methods to identify the defective ones.

WO 2005/008223 A3



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*